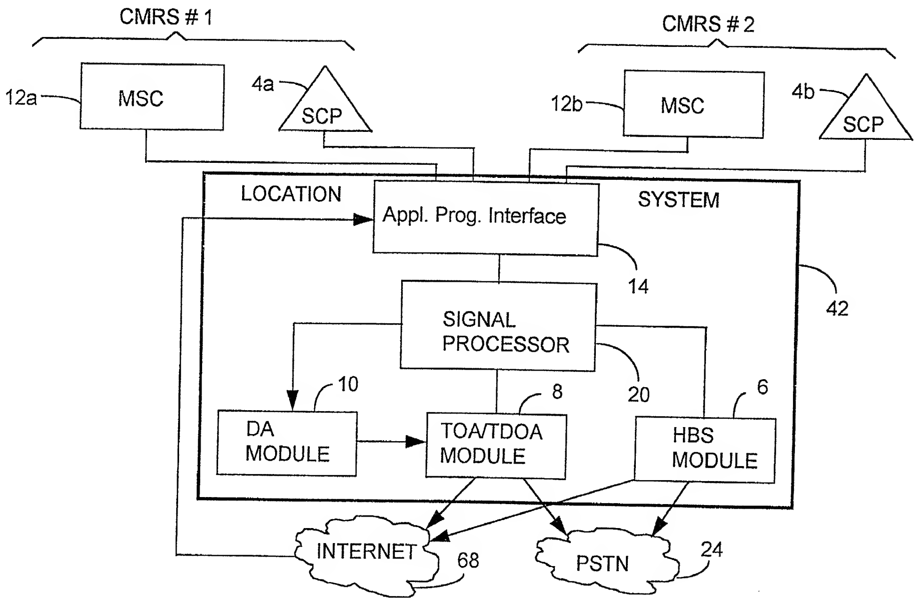


FIG. 1: WIRELESS LOCATION USING MULTIPLE CMRSs

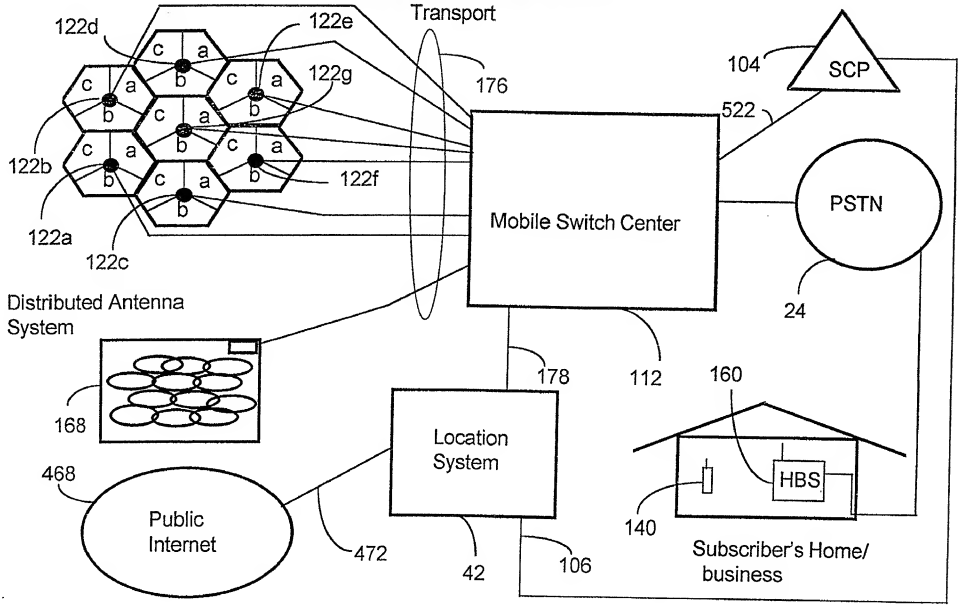


Fig. 2: WIRELESS LOCATION INTELLIGENT NETWORK ARCHITECTURE

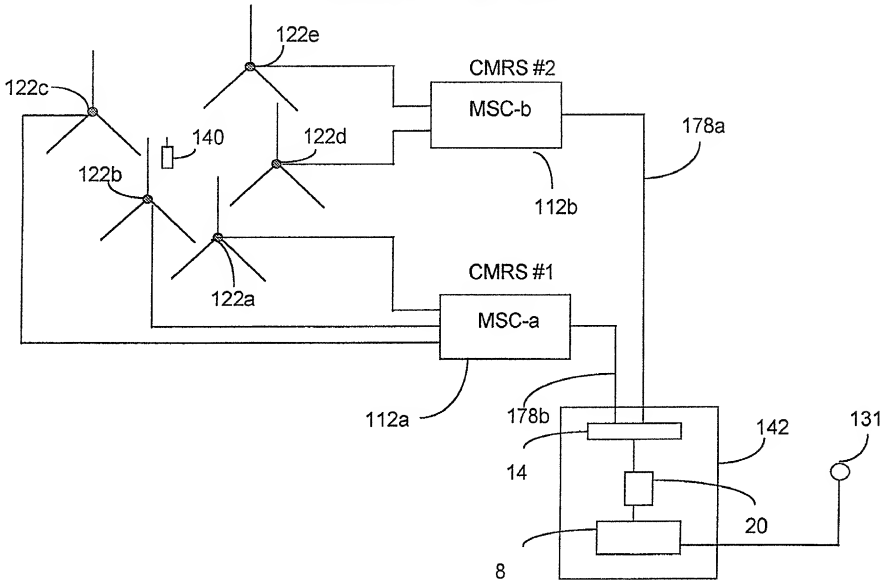


FIG. 3: SHARING CMRS BASE STATION INFRASTRUCTURE

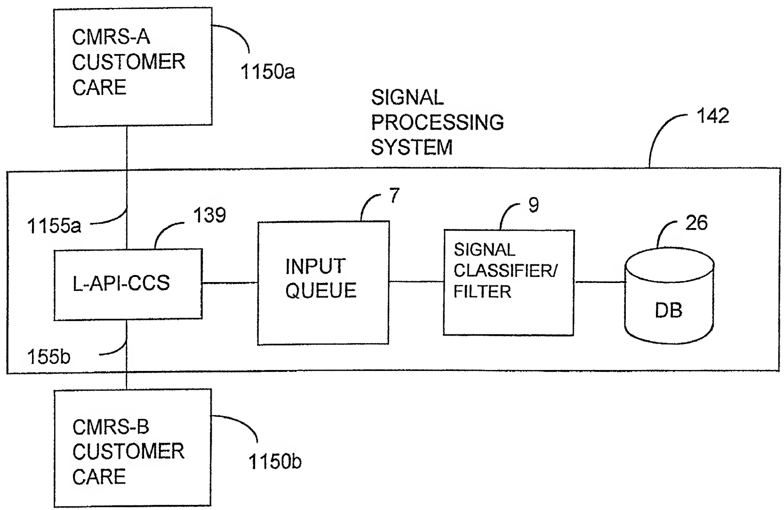


FIG. 4: LOCATION PROVISIONING VIA MULTIPLE CMRS

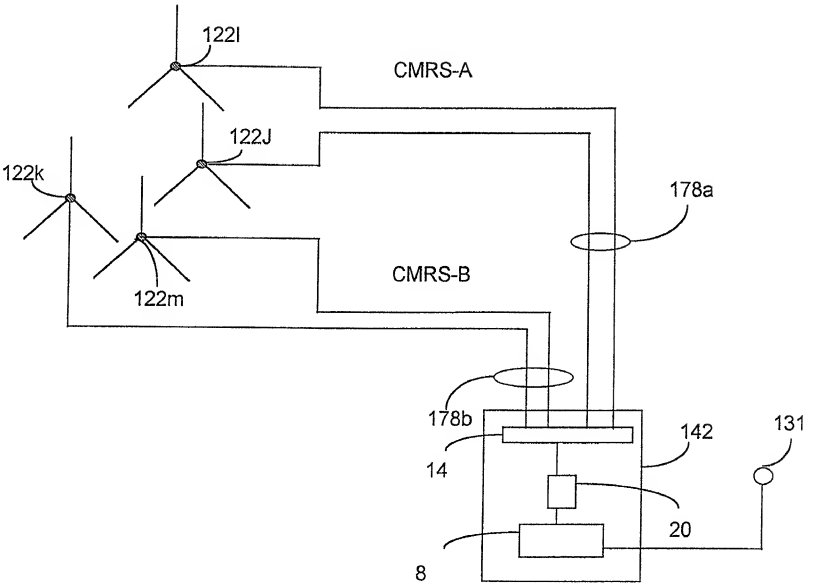


FIG. 5: LOCATION CENTER BASE STATION ACCESS, MULTIPLE CMRS

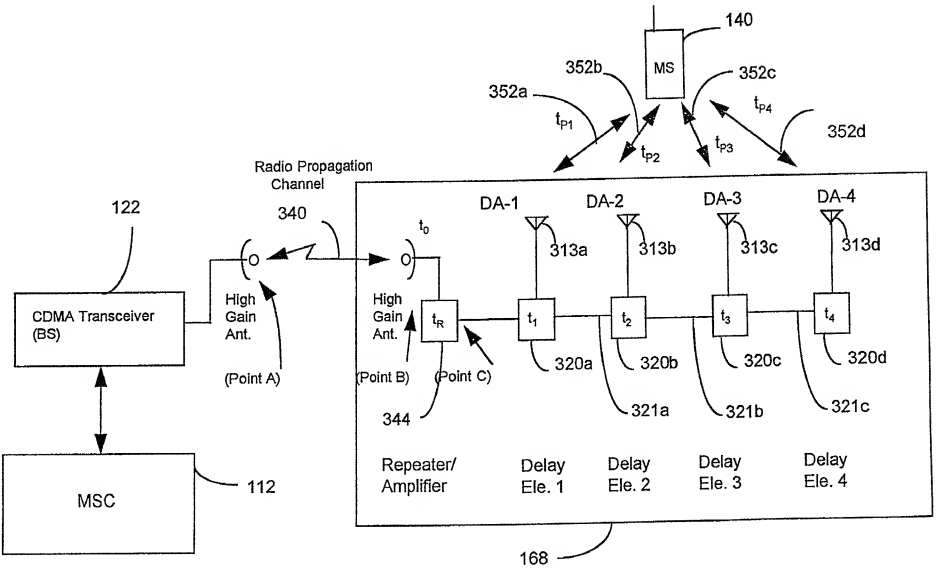


FIG. 6: DISTRIBUTED ANTENNA DELAY CHARACTERIZATION

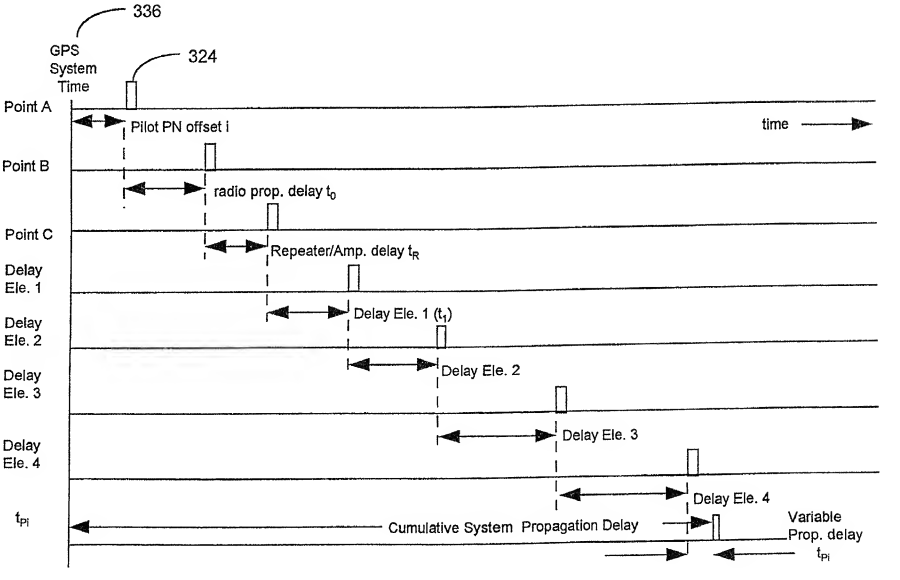


Fig. 7: DA System Timing Diagram

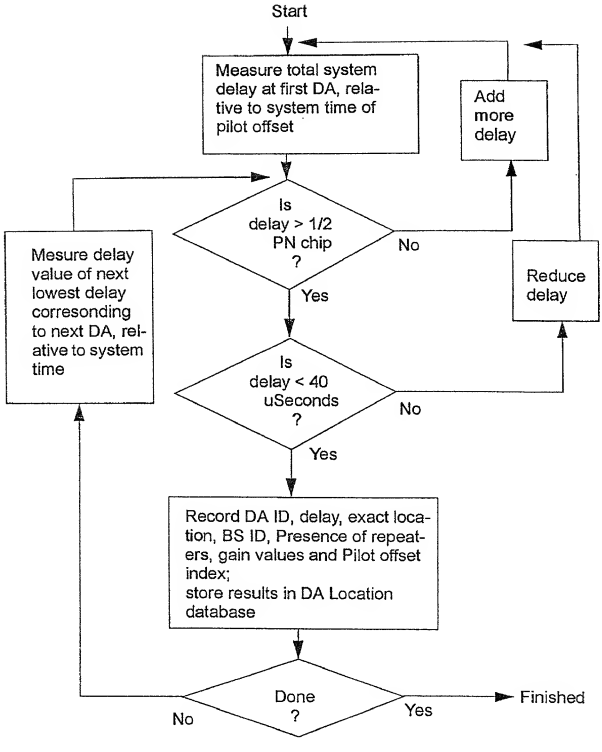


FIG. 8: DA Installation Procedure for Wireless Location

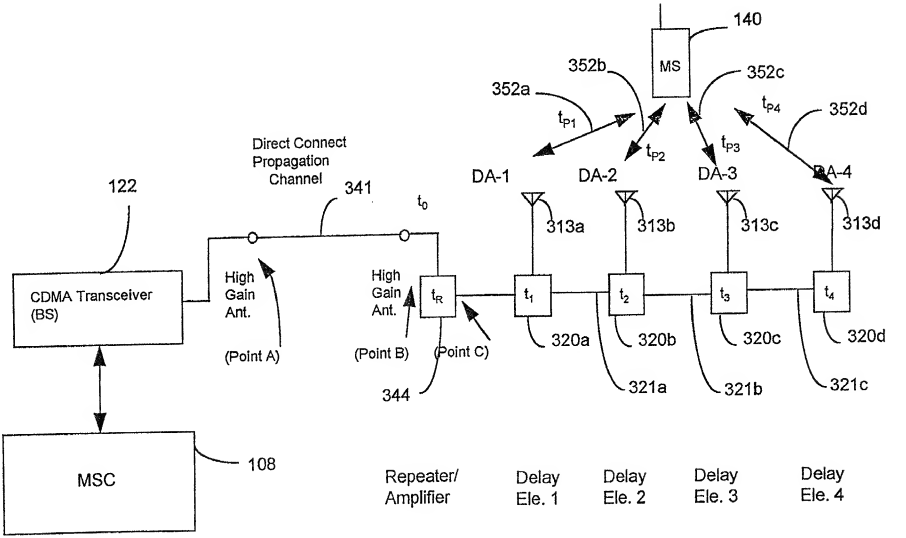


Figure 9: A Direct-Connect Distributed Antenna System

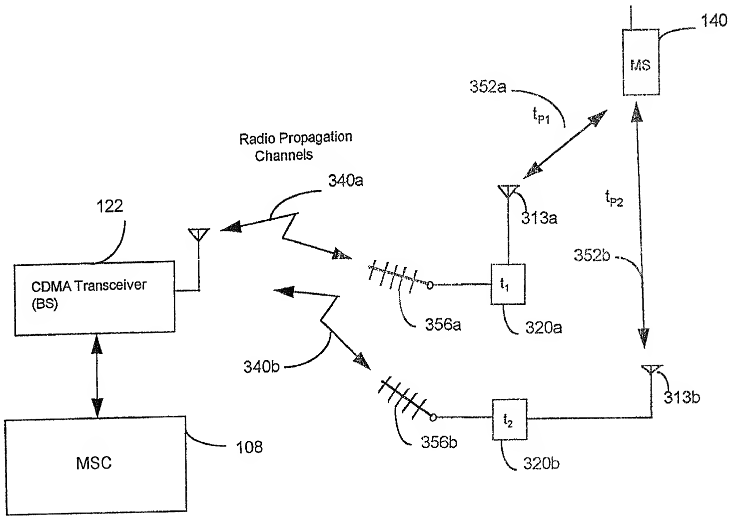


Figure 10: Multipoint Distributed Antenna System

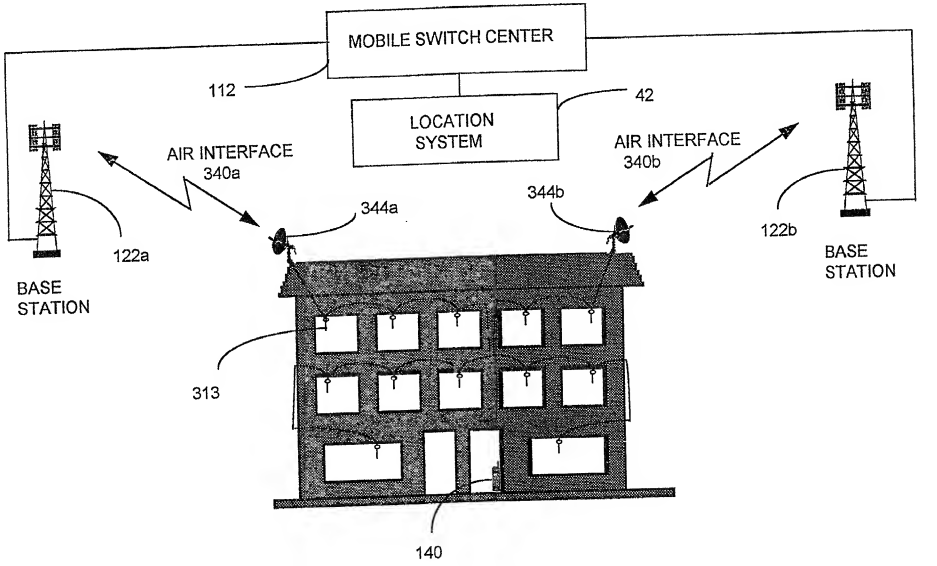


FIG. 11: Dual-Microwave Access Distributed Antenna Example

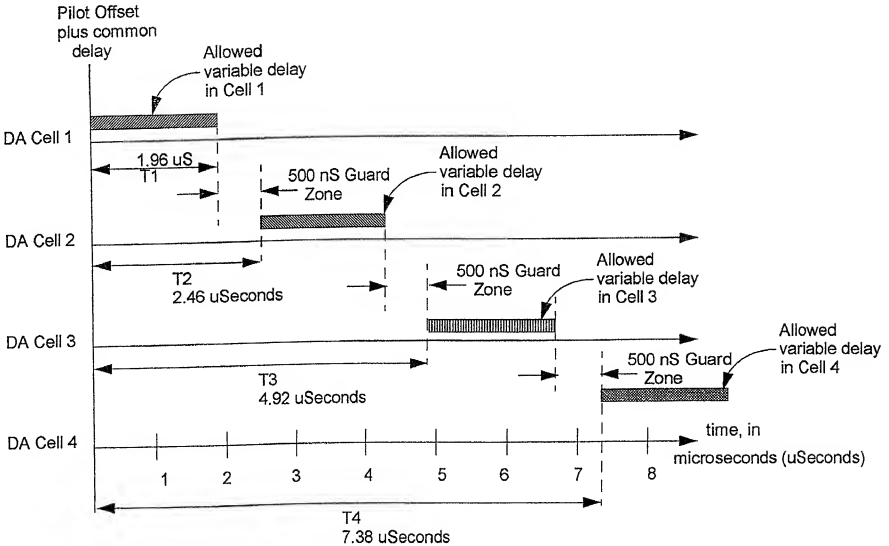
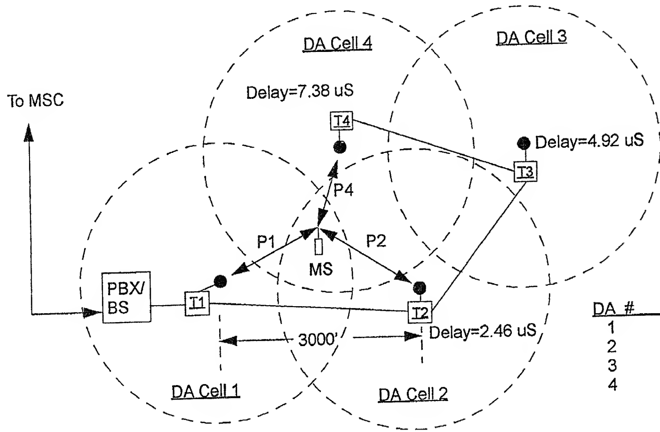


FIG. 12: ALLOWABLE DELAY SPREADS AMONG DA CELLS

All distributed omni antennas have a maximum coverage radius of 2,000 feet



DA #	X,Y Location
1	(0,0)
2	(3000, -20)
3	(1600, 2800)
4	(1600, 2800)

FIG. 13: DA Cell Geometry Illustration

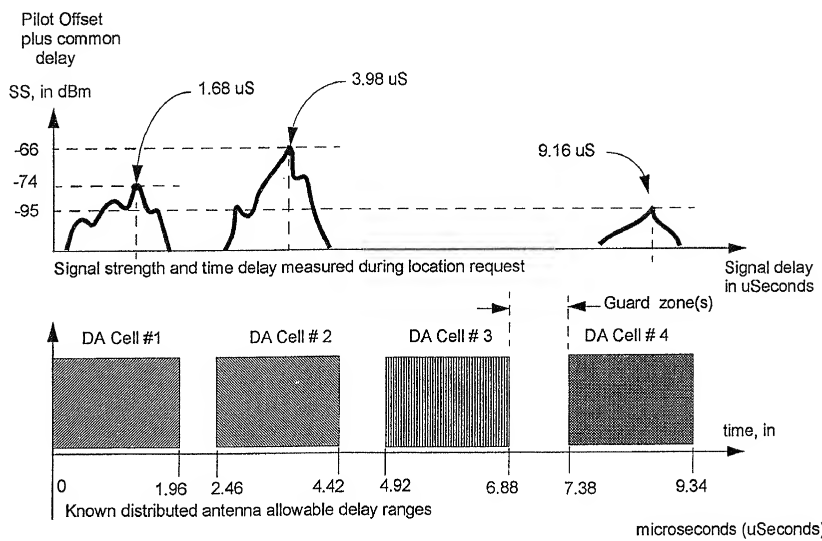


FIG. 14: LOCATION MEASUREMENTS ILLUSTRATION

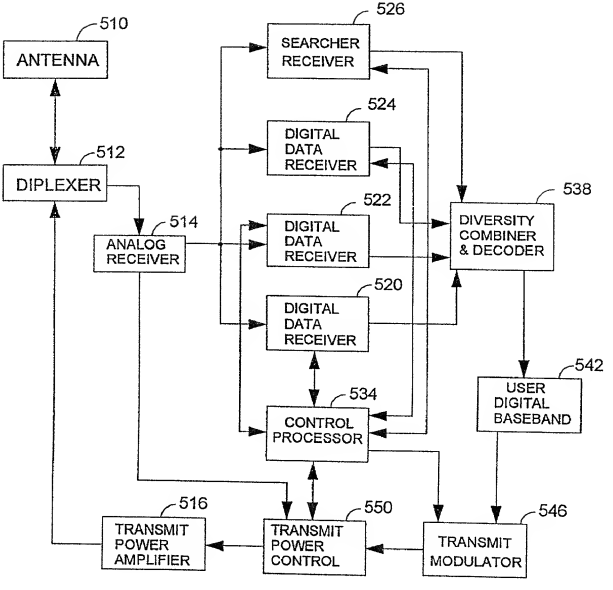


FIG. 15: CDMA Mobile Station Prior Art

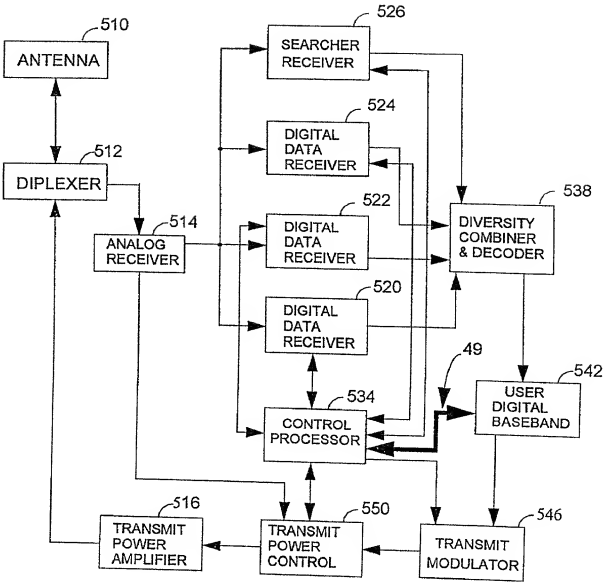


FIG. 16: MS Modification for RF Signal Telemetry

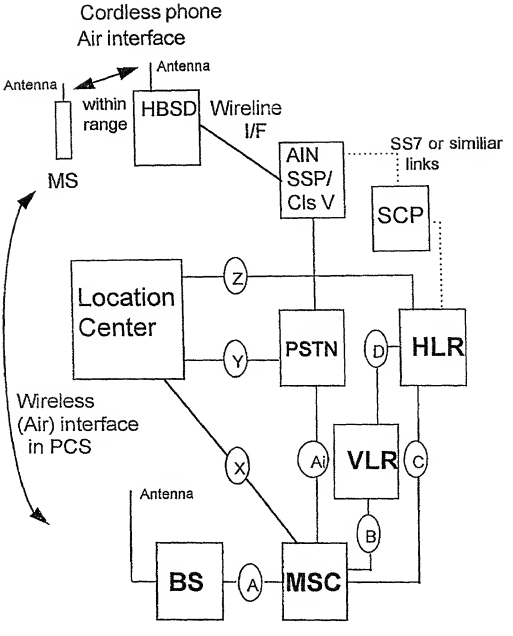


Figure 17: Location and a Home Base Station

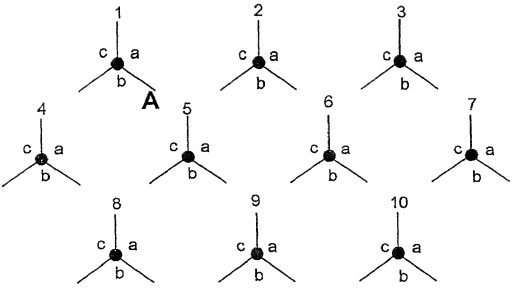


Fig. 18: MS at location A, detects BSs 1b, 5c and 4a

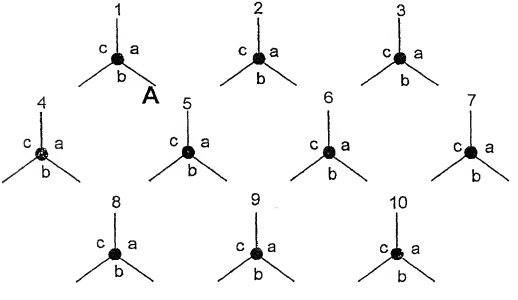


Fig. 19: MS at location A, detects BSs 1b, 5c, 2c and 4a

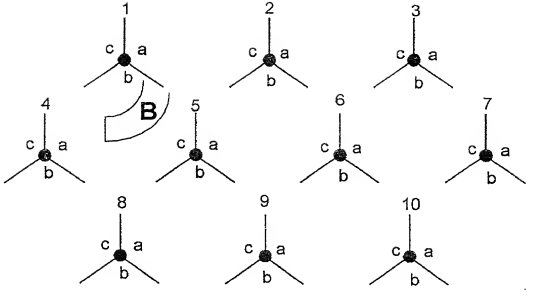


Fig. 20: MS at location B, detects BSs 1b and 2a

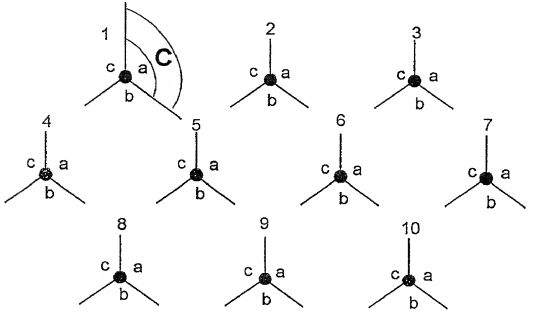
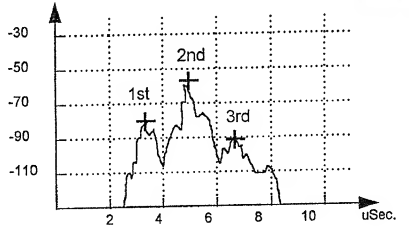
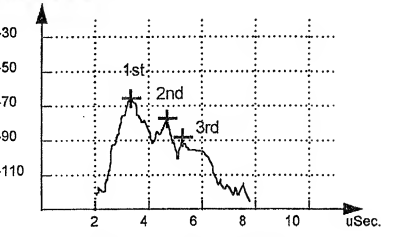


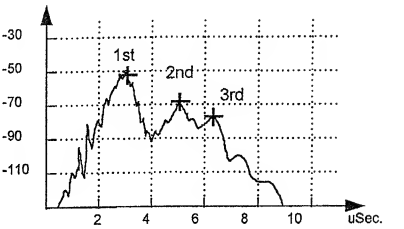
Fig. 21: MS at location C, detects only BS 1a



Delay Spread: MS RX of BS-1
(16th & Stout St.)

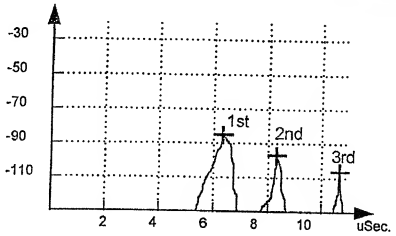


Delay Spread: MS RX of BS-5
(18th & Washington St.)

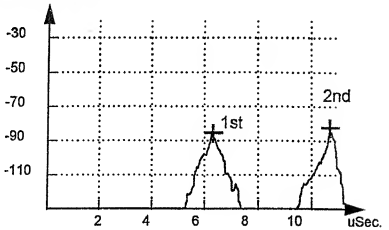


Delay Spread: MS RX of BS-2 (17th & Lincoln)

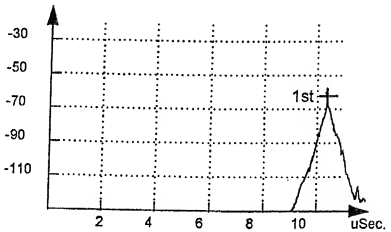
Figure 22: MS Received Delay Spreads of 3 Base Stations (Dense Urban Canyon)



Delay Spread: MS RX of BS-151
(South Table Mesa C.O.)



Delay Spread: MS RX of BS-152
(GC Mining Tower)



Delay Spread: MS RX of BS-154 (Hwy 91 & Rocky Flats)

Figure 23: MS Received Delay Spreads of 3 Base Stations (Rural Setting)

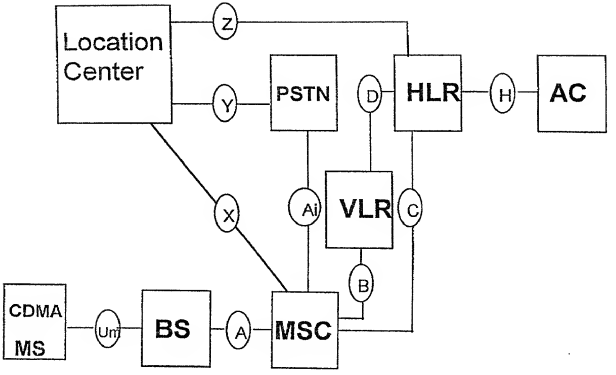


Figure 24: Location and CTIA/TR45
Network Reference Model

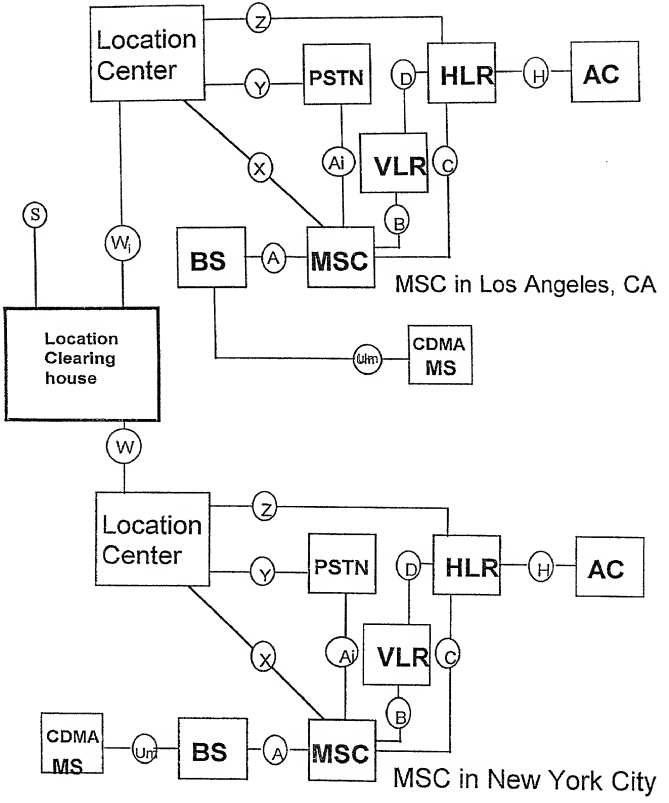


Figure 25: National Location Clearinghouse Structure

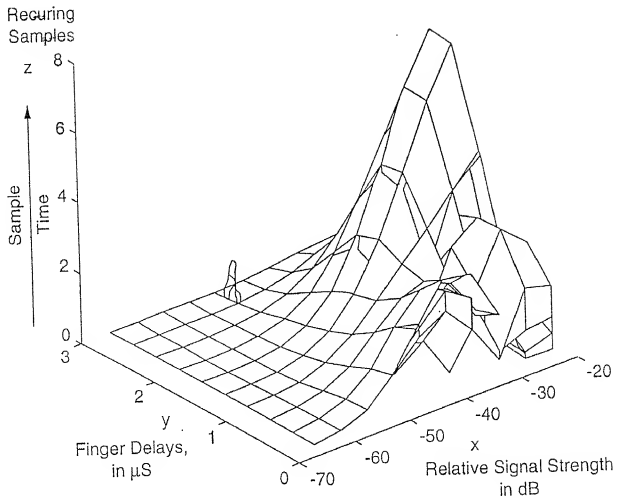

Recuring
Samples
z
8
6
4
2
0
Sample
Time
3
2
y
1
0
Finger Delays,
in µS
-70
-60
-50
-40
-30
-20
x
Relative Signal Strength
in dB

Fig. 26

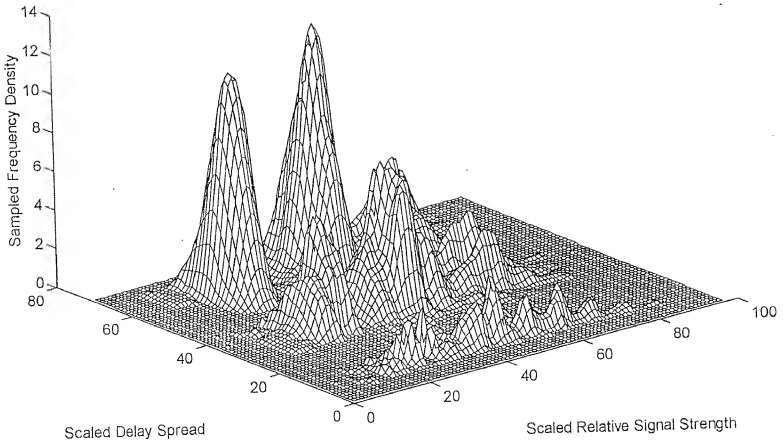

Sampled Frequency Density
14
12
10
8
6
4
2
0
80
60
40
20
0
0
20
40
60
80
100
Scaled Delay Spread
Scaled Relative Signal Strength

Fig. 27

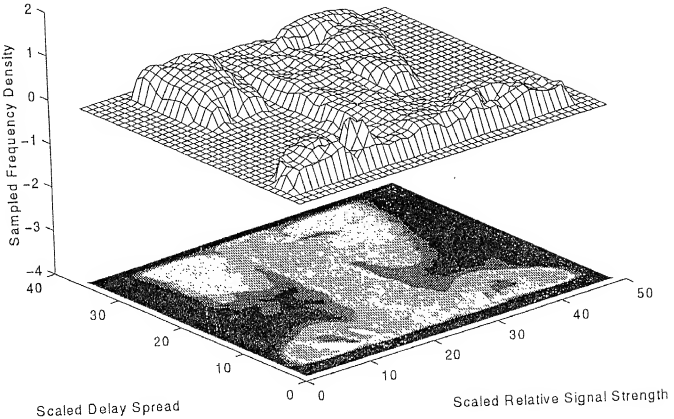

Sampled Frequency Density
2
1
0
−1
−2
−3
−4
40
30
20
10
0
Scaled Delay Spread
0
10
20
30
40
50
Scaled Relative Signal Strength

Fig. 28

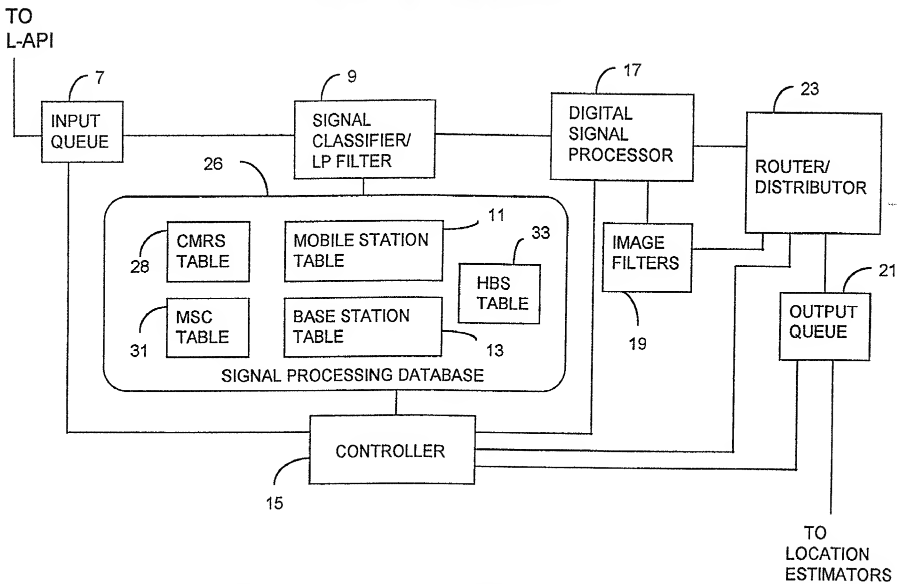


Fig. 29: Signal Processing Subsystem

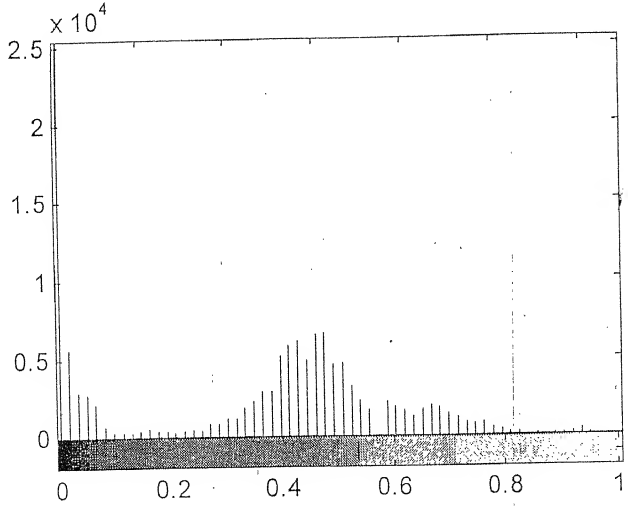


FIG. 30

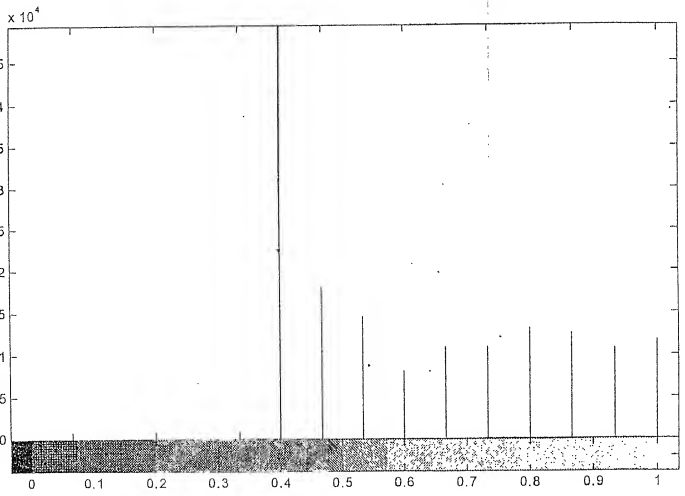


FIG. 31

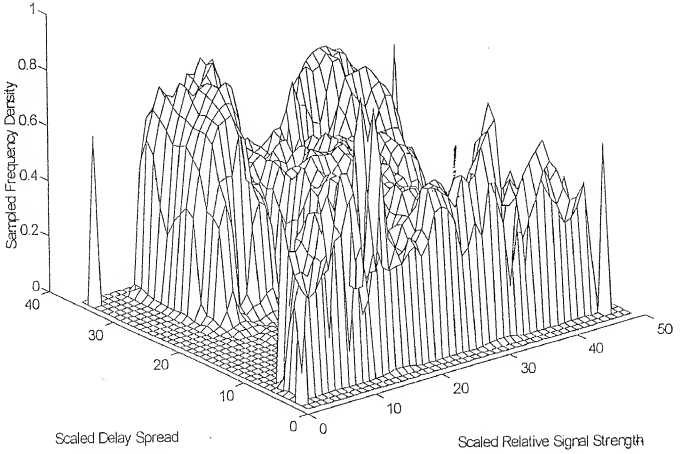

Sampled Frequency Density
1
0.8
0.6
0.4
0.2
0
40
30
20
10
0
Scaled Delay Spread
0
10
20
30
40
50
Scaled Relative Signal Strength

FIG. 32

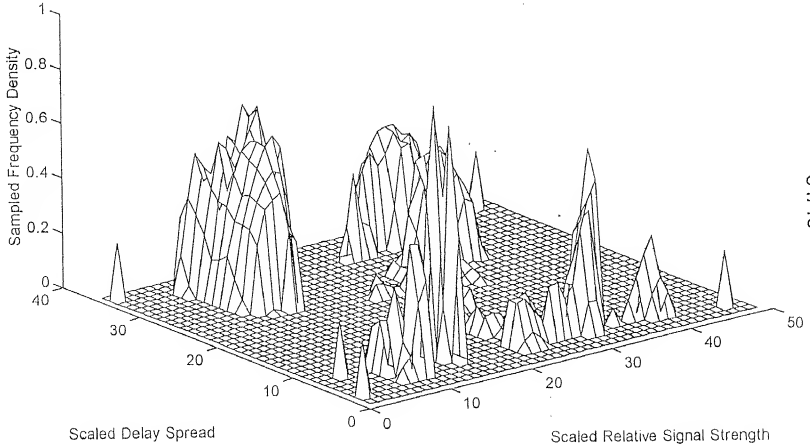

Sampled Frequency Density
1
0.8
0.6
0.4
0.2
0
40
30
20
10
0
Scaled Delay Spread
0
10
20
30
40
50
Scaled Relative Signal Strength

Fig. 33

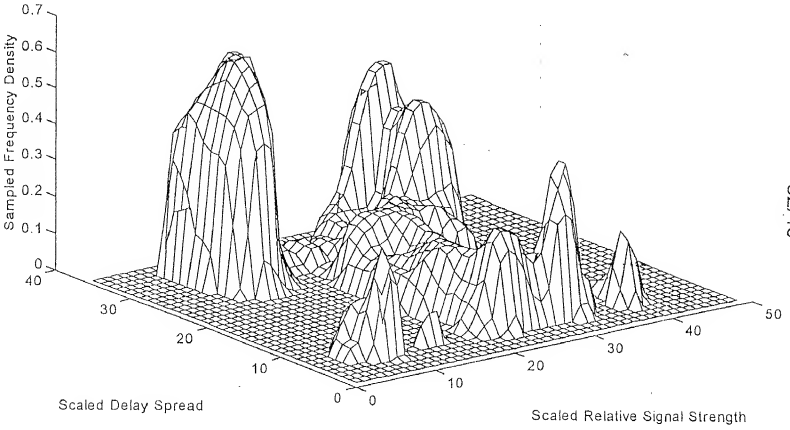

Sampled Frequency Density
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
40
30
20
10
0
Scaled Delay Spread
0
10
20
30
40
50
Scaled Relative Signal Strength

Fig. 34

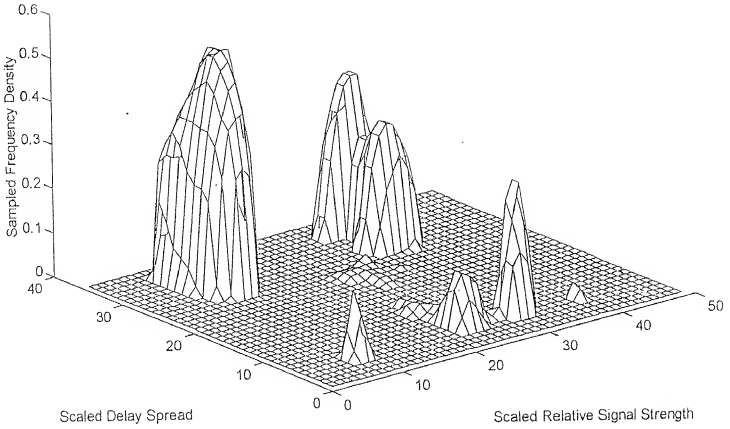

Sampled Frequency Density
0.6
0.5
0.4
0.3
0.2
0.1
0
40
30
20
10
0
Scaled Delay Spread
0
10
20
30
40
50
Scaled Relative Signal Strength

Fig. 35

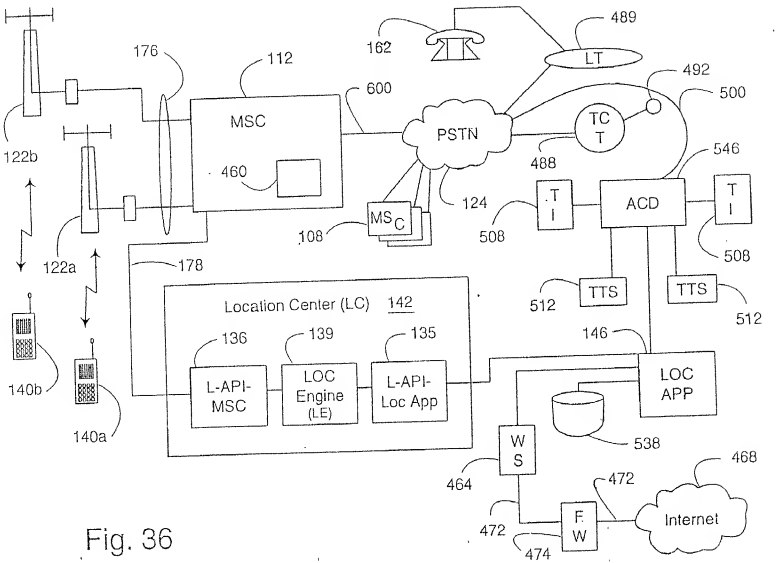

176
112
162
489
LT
492
500
MSC
600
PSTN
TC
T
122b
460
488
546
124
T
I
ACD
T
I
MS
C
108
508
508
122a
178
512
TTS
TTS
512
Location Center (LC) 142
146
136
139
135
L-API-
MSC
LOC
Engine
(LE)
L-API-
Loc App
LOC
APP
140b
140a
538
W
S
468
464
472
Internet
F
W
472
474

Fig. 36

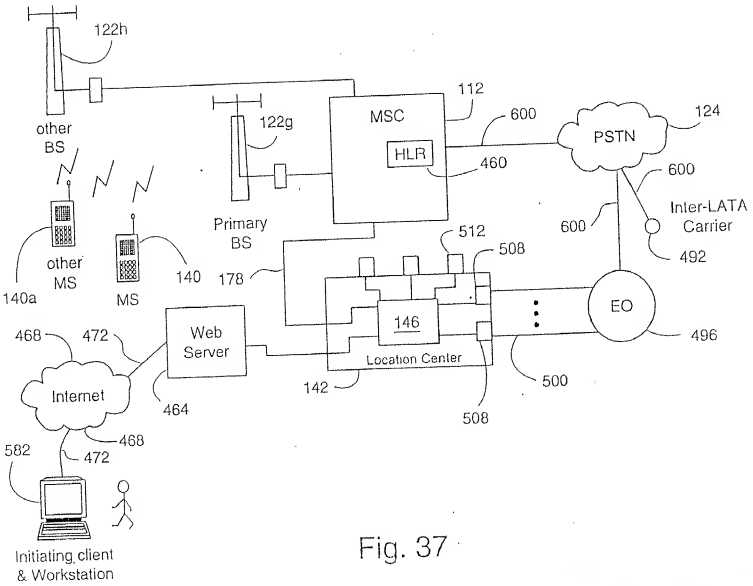

122h
other BS
122g
MSC
112
600
124
PSTN
HLR
460
600
Inter-LATA Carrier
600
492
Primary BS
512
508
other MS
140a
MS
140
178
146
Location Center
EO
496
468
472
Web Server
Internet
464
142
500
508
468
472
582
Initiating client & Workstation

Fig. 37

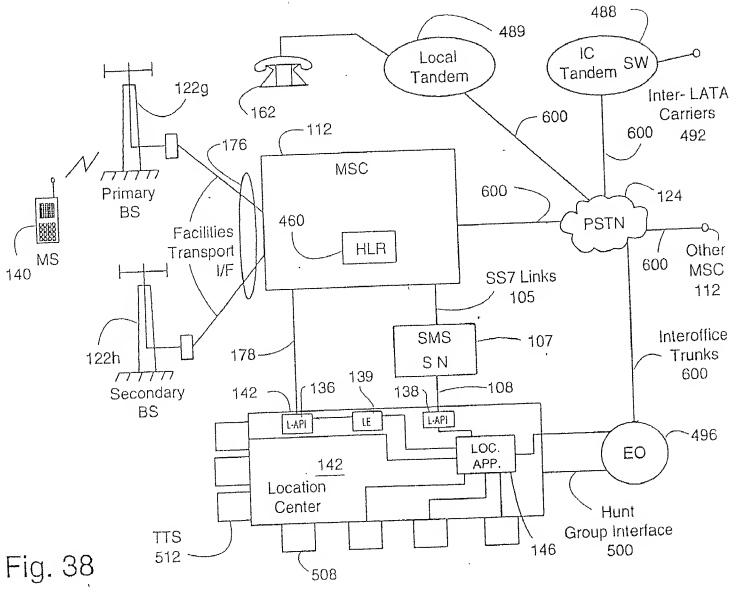

Local Tandem
489
488
IC Tandem
SW
Inter- LATA Carriers
492
600
600
600
600
600
122g
162
176
112
MSC
Primary BS
Facilities Transport I/F
460
HLR
124
PSTN
Other MSC 112
MS
140
SS7 Links 105
SMS
S N
107
Interoffice Trunks 600
122h
178
Secondary BS
142
136
139
138
108
L-API
LE
L-API
EO
496
LOC. APP.
142
Location Center
Hunt Group Interface 500
TTS 512
508
146

Fig. 38

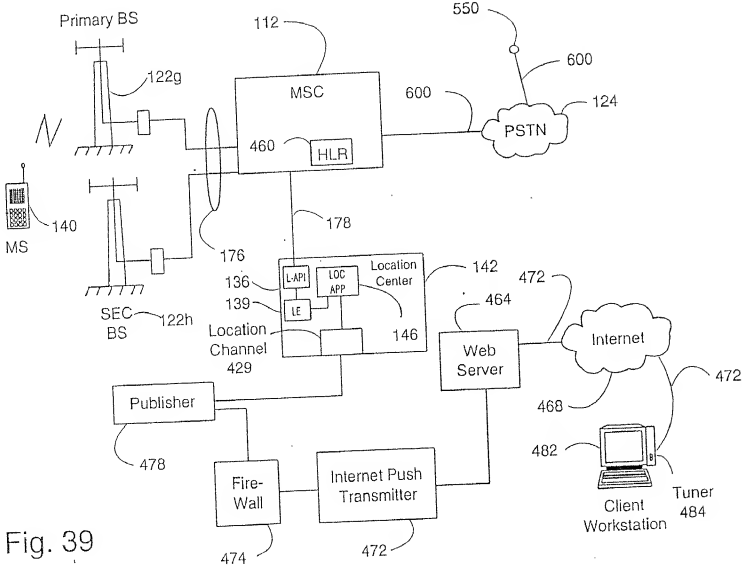

Primary BS
112
550
600
122g
MSC
600
124
PSTN
460
HLR
140
MS
178
176
L-API
LOC APP
Location Center
142
136
139
LE
472
464
SEC BS
122h
Location Channel 429
146
Web Server
Internet
472
Publisher
468
478
482
Fire-Wall
Internet Push Transmitter
Tuner 484
Client Workstation
474
472

Fig. 39

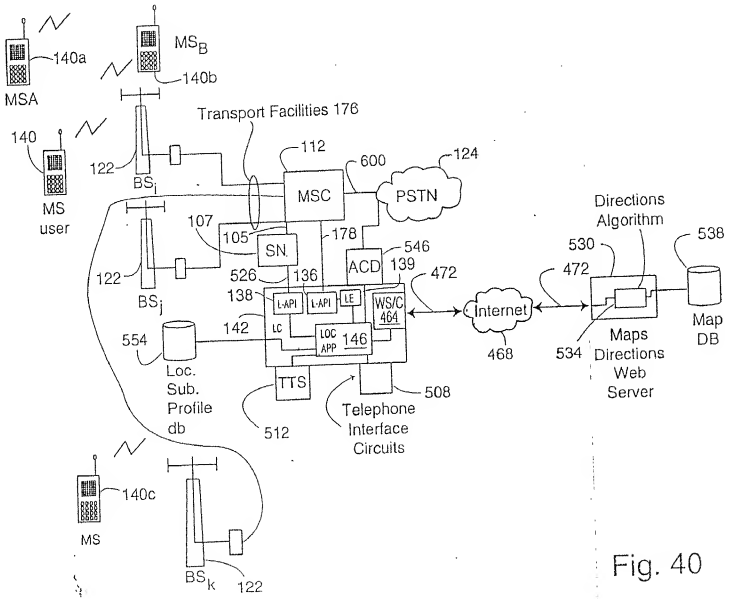

MSA
140a
MS$_B$
140b
Transport Facilities 176
140
MS user
122
BS$_j$
112
MSC
600
PSTN
124
107
105
SN.
178
546
ACD
139
526
136
472
138
L-API
L-API
LE
WS/C 464
142
LC
LOC APP
146
554
Loc. Sub. Profile db
TTS
512
508
Telephone Interface Circuits
Internet
468
Directions Algorithm
530
538
534
Maps Directions Web Server
Map DB
140c
MS
BS$_k$
122

Fig. 40

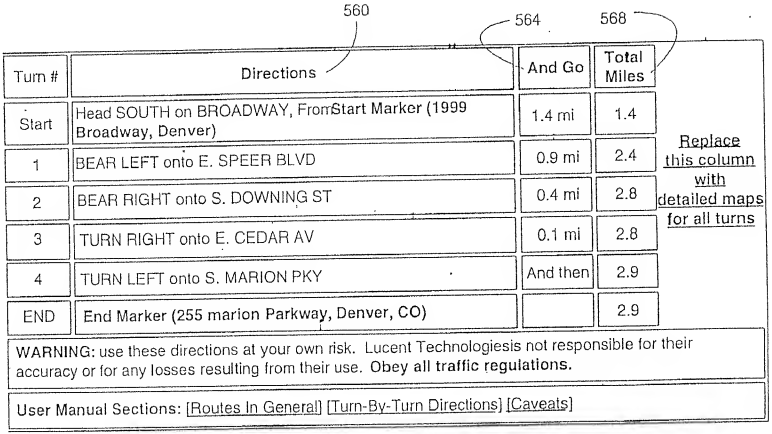

560
564
568
Turn #
Directions
And Go
Total Miles
Start
Head SOUTH on BROADWAY, From Start Marker (1999 Broadway, Denver)
1.4 mi
1.4
1
BEAR LEFT onto E. SPEER BLVD
0.9 mi
2.4
2
BEAR RIGHT onto S. DOWNING ST
0.4 mi
2.8
3
TURN RIGHT onto E. CEDAR AV
0.1 mi
2.8
4
TURN LEFT onto S. MARION PKY
And then
2.9
END
End Marker (255 marion Parkway, Denver, CO)
2.9
Replace this column with detailed maps for all turns
WARNING: use these directions at your own risk. Lucent Technologiesis not responsible for their accuracy or for any losses resulting from their use. Obey all traffic regulations.
User Manual Sections: [Routes In General] [Turn-By-Turn Directions] [Caveats]

Fig. 41

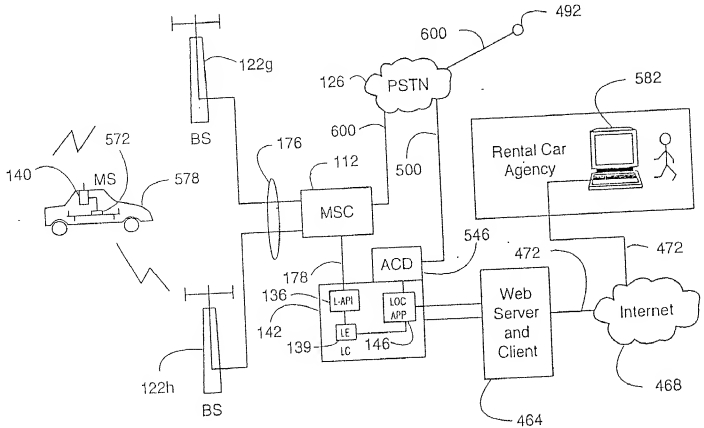

492
600
122g
126
PSTN
582
572
BS
176
600
Rental Car
Agency
140
MS
578
112
500
MSC
546
ACD
472
472
178
136
L-API
LOC
APP
Web
Server
and
Client
Internet
142
LE
139
LC
146
122h
BS
468
464

Fig. 42

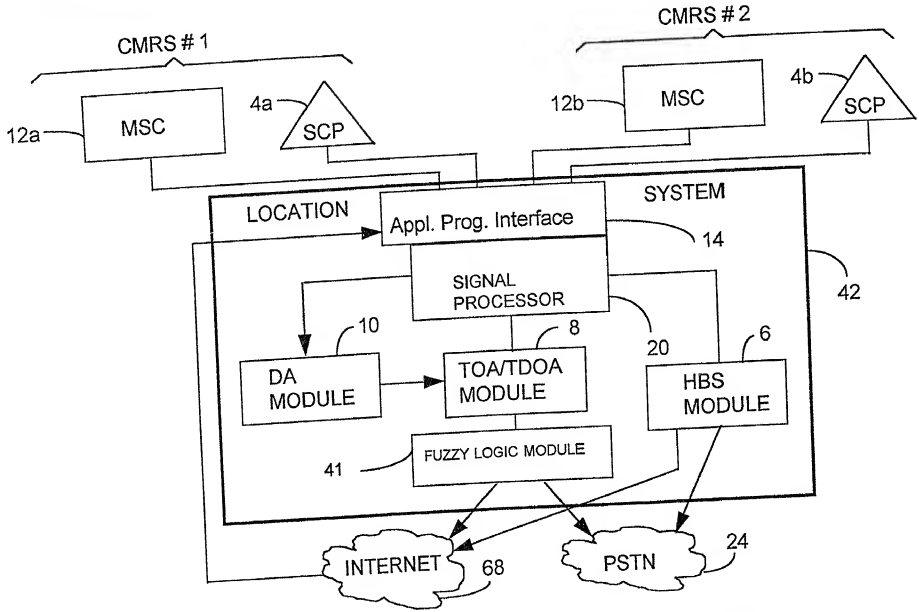


FIG. 43: WIRELESS LOCATION USING FUZZY LOGIC